

TABLE 1.—Solar radiation intensities during November, 1930

(Gram-calories per minute per square centimeter of normal surface)

## Washington, D. C.

Sun's zenith distance											
8 a.m. 78.7° 75.7° 70.7° 60.0° 0.0° 60.0° 70.7° 75.7° 78.7° Noon											
Date	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
		e.	5.0	4.0	3.0	2.0	1.0	2.0	3.0	4.0	
Nov. 1	mm.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	mm.
Nov. 6	3.99	0.86	1.00	1.08			1.22	0.96	0.75	0.55	3.00
Nov. 7	2.49						1.12	0.94	0.84		2.49
Nov. 8	1.88				1.19		1.12	0.94	0.84		2.36
Nov. 10	2.74				1.35		1.35	1.20	1.01		2.36
Nov. 28	4.37	0.71	0.86	0.98	1.12						3.81
Nov. 28	1.07		0.95	1.19	1.26			1.12	0.90	0.66	0.98
Means		(0.78)	0.94	1.03	1.26		1.23	1.06	0.88	(0.60)	
Departures		+0.03	+0.08	+0.08	+0.08		+0.06	+0.07	+0.04	-0.13	

## Madison, Wis.

	5.16				1.07		0.94			5.16
Nov. 4	5.16				1.07		0.94			5.16
Nov. 5	2.87	1.06	1.15	1.26	1.42		1.22			2.16
Nov. 6	2.26		1.13	1.26	1.36		1.13			1.78
Nov. 7	2.36				1.23		0.83			2.06
Nov. 10	4.95		0.57	0.77	1.10		0.89			5.56
Nov. 12	6.76	0.69	0.80	1.00	1.15					7.57
Nov. 17	4.57				0.98		0.96			5.36
Nov. 19	6.76						1.19			8.48
Nov. 22	3.63						1.03			3.99
Means		(0.88)	0.91	1.07	1.19		1.03			
Departures		+0.00	-0.10	-0.07	-0.10		-0.10			

## Lincoln, Nebr.

	4.37		0.82	1.01	1.34		1.25	1.00	0.95	0.77	4.17
Nov. 4	4.37		0.82	1.01	1.34		1.25	1.00	0.95	0.77	4.17
Nov. 5	2.49		1.11	1.26			1.21	1.10	0.97	1.96	
Nov. 8	3.81		0.78	0.94	1.18		1.19	1.01	0.85	0.73	6.50
Nov. 10	7.04	0.91	1.02	1.12	1.31		1.30				7.87
Nov. 11	6.50	0.51	0.78	0.98	1.12						4.95
Nov. 13	0.50	0.91	1.02	1.16	1.32		1.11	0.94	0.53		7.29
Nov. 17	4.95	0.63	0.80	1.09	1.37		1.40	1.22	1.08	0.96	6.02
Nov. 18	5.36	0.63	0.73	0.92	1.24		1.26	1.12	1.00	0.83	7.29
Nov. 21	2.87	1.01	1.09	1.28	1.46			1.27			3.00
Nov. 22	3.45	1.00	1.06	1.26							3.63
Nov. 25	3.63		1.13	1.24							2.87
Means		0.80	0.94	1.12	1.29		1.28	1.13	0.99	0.85	
Departures		-0.10	-0.08	-0.08	-0.07		-0.07	-0.06	-0.05	-0.07	

† Extrapolated.

TABLE 2.—Total solar radiation (direct+diffuse) received on a horizontal surface

Week beginning	Average daily totals									
	Washington	Madison	Lincoln	Chicago	New York	Twin Falls	Pittsburgh	Gainesville	Fresno	La Jolla
1930										
Oct. 29	242	220	306	147	120	305	133	319	334	321
Nov. 5	247	225	286	136	189	234	138	309	281	276
Nov. 12	81	128	223	86	68	178	83	281	196	210
Nov. 19	137	110	176	86	113	162	161	293	280	292
Nov. 26	214	156	186	87	138	164	116	206	217	233
Departures from weekly normals										
Oct. 29	+6	+36	+66	+10	-48	+29		+21	+53	
Nov. 5	+20	+56	+57	+20	+45	+31		-4	+22	
Nov. 12	-105	-9	+29	-13	-54	-39		-63	-42	
Nov. 19	-41	-20	-27	-5	+4	+59		+38	+26	
Nov. 26	+55	+30	+1	+5	+41	+59		+5	-47	
Accumulated departures on Dec. 2	+8183	+1806	-1218	+679	+1176			-2136	-1412	

## POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, Perkins, and Mount Wilson Observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column.]

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
1930							
Nov. 1 (Naval Observatory)	10 40	+37.0	116.2	-5.0		231	
		+38.0	117.2	-10.0		46	
		+51.0	130.2	-7.0		525	802
Nov. 2 (Naval Observatory)	10 45	+49.5	115.5	-11.0	12		
		+53.5	119.5	-5.0		278	
		+65.5	131.5	-8.0		401	691
Nov. 3 (Naval Observatory)	10 44	+76.0	136.8	+12.5	77		
		+62.5	115.3	-11.0	9		
		+67.0	119.8	-13.0	6		
		+67.5	120.3	-5.0		278	
		+80.0	132.8	-7.0		231	601
Nov. 4 (Mount Wilson)	11 40	+61.0	138.0	+12.0	66		
		+55.0	124.0	-6.0		260	326
Nov. 5 (Naval Observatory)	13 16	+46.5	138.5	+12.5	62		62
Nov. 6 (Naval Observatory)	10 47	+34.5	138.7	+12.5	56		56
Nov. 7 (Naval Observatory)	10 43	+21.5	138.6	+12.5	56		56
Nov. 8 (Naval Observatory)	13 18	-6.5	139.0	+12.5	43		43
Nov. 9 (Naval Observatory)	10 45	+6.0	139.7	+12.5	34		34
Nov. 10 (Naval Observatory)	10 49	+19.0	139.5	+13.0	31		31
Nov. 11 (Naval Observatory)	13 58	+34.0	139.5	+13.0	12		12
Nov. 12 (Naval Observatory)	10 45	+45.5	139.6	+13.0	9		9
Nov. 14 (Mount Wilson)	14 0	+66.0	200.0	+5.0		299	299
Nov. 15 (Mount Wilson)	13 20	-51.0	202.2	+5.0		400	400
Nov. 16 (Yerkes Observatory)	12 33	-33.8	206.6	+3.2	51		
		-34.9	205.5	+3.5	29		
		-37.7	202.7	+4.7	26		
		-37.4	203.0	+5.4		22	
		-40.9	199.5	+7.6		71	
		-44.0	196.4	+3.0	112		311
Nov. 17 (Yerkes Observatory)	14 48	-18.1	207.9	+4.3	98		
		-19.1	206.9	+4.4	62		
		-21.6	204.4	+4.6		22	
		-22.4	203.6	+5.4		36	
		-25.6	200.4	+6.2	16		
		-26.1	199.9	+8.2		28	
		-30.4	195.6	+4.9		202	464
Nov. 18 (Perkins Observatory)	10 30	-17.0	197.9	+3.5	124		
		-12.5	202.4	+5.0		93	
		-5.0	209.9	+3.0		155	372
Nov. 19 (Perkins Observatory)	9 10	-72.5	130.0	-7.0		136	
		-4.0	198.5	+2.5	124		
		-0.5	202.0	+5.0	62		
		+4.5	207.0	+4.0		124	
		+9.0	211.5	+3.0		155	561
Nov. 20 (Naval Observatory)	12 18	-57.0	130.8	-8.0		370	
		+15.0	202.8	+3.5		278	648
Nov. 21 (Mount Wilson)	11 45	-72.0	102.9	-8.0	444		
		-71.0	103.9	+8.0		130	
		-40.0	134.9	-6.0		264	
		+32.0	206.9	+2.0		292	1,130
Nov. 22 (Naval Observatory)	14 24	-66.0	94.3	+3.5	62		
		-57.5	102.8	+5.5	123		
		-57.0	103.3	-9.5		62	
		-27.0	133.3	-7.5		216	
		+45.0	205.3	+3.5		278	741
Nov. 23 (Naval Observatory)	11 1	-54.5	94.5	+4.0		62	
		-46.0	103.0	+6.0	108		
		-45.0	104.0	-9.0		386	
		-16.0	133.0	-7.5	216		
		+56.5	205.5	+3.5		231	1,003
Nov. 24 (Naval Observatory)	12 42	-39.5	95.4	+3.5	46		
		-32.0	102.9	+5.5	93		
		-31.0	103.9	-9.0		401	
		-0.5	134.4	-7.0		216	
		+47.5	182.4	-27.5		46	
		+74.0	208.9	+3.5		247	1,049
Nov. 25 (Naval Observatory)	11 32	-27.5	94.8	+4.0	15		
		-19.5	102.8	+5.7	77		
		-18.0	104.3	-9.0		401	
		+12.5	134.8	-7.5	108		
		+61.0	183.3	-27.5		77	678
Nov. 26 (Naval Observatory)	10 43	-49.5	60.1	+8.5	22		
		-35.5	74.1	+14.5		43	
		-12.0	97.6	+3.0		15	
		-7.5	102.1	+4.5		77	
		-5.5	104.1	-9.5		386	
		+26.0	135.6	-8.0		108	
		+78.5	188.1	-28.0		154	805
Nov. 27 (Naval Observatory)	11 0	-47.5	48.8	+17.5	31		
		-36.0	60.3	+8.0		62	
		+7.5	103.8	+5.0		46	
		+8.0	104.3	-9.5		324	
		+40.5	130.8	-8.0		93	556

## POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern stand-ard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longi-tude	Lati-tude	Spot	Group	
1930	h m	°	°	°			
Nov. 28 (Naval Observatory)---	12 5	-51.5	31.0	+7.0	93		
		-33.5	49.0	+17.5	46		
		-21.5	61.0	+8.0	108		
		-9.5	73.0	+16.5	22		
		+22.0	104.5	+5.5	31		
		+23.0	105.5	-9.0	340		
		+55.5	138.0	-7.0	46		686
Nov. 29 (Naval Observatory)---	11 40	-37.0	32.5	+7.0	77		
		-21.0	48.5	+19.5	31		
		-8.5	61.0	+8.0	93		
		+10.0	79.5	+14.5	77		
		+35.0	104.5	+16.0	37		
		+35.5	105.0	-9.0	324		639
Nov. 30 (Mount Wilson)-----	13 30	-19.0	36.4	+8.0	42		
		-1.0	54.4	+17.0	1		
		+7.0	62.4	+9.0	27		
		+25.0	80.4	+15.0	101		
		+30.0	105.4	-9.0	374		
		+51.0	106.4	+6.0	2		547
Mean daily area for November-----							472

 PROVISIONAL RELATIVE SUN-SPOT NUMBERS FOR  
NOVEMBER, 1930 <sup>1</sup>

[Data furnished through the courtesy of Prof. W. Brunner, University of Zurich, Switzerland]

November, 1930	Relative numbers	November, 1930	Relative numbers	November, 1930	Relative numbers
1-----	57	11-----	8	21-----	dd 66
2-----	41	12-----	14	22-----	70
3-----	25	13-----	0	23-----	68
4-----	27	14-----	12	24-----	a 51
5-----	16	15-----	d 14	25-----	Wc 58
6-----	8	16-----		26-----	Eabc 76
7-----	8	17-----	26	27-----	72
8-----	9	18-----	d 31	28-----	67
9-----	8	19-----	b	29-----	61
10-----	15	20-----	61	30-----	54

Mean, 28 days=36.5.

<sup>1</sup> Dependent alone on observations at Zurich and its station at Arosa.

a= Passage of an average-sized group through the central meridian.

b= Passage of a large group through the central meridian.

c= New formation of a large or average-sized center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.

d= Entrance of a large or average-sized center of activity on the east limb.

## AEROLOGICAL OBSERVATIONS

By L. T. SAMUELS

Free-air temperatures during November were considerably above normal at Ellendale, moderately above at Royal Center, slightly below at Broken Arrow and moderately below at Groesbeck and Due West. (See Table 1.) This is in close agreement with the distribution of surface departures shown in Chart I.

The departures of free-air relative humidities were in general, of opposite sign to those of temperature.

Free-air vapor pressures were above normal at all levels at Ellendale, Royal Center, and Broken Arrow and in the upper levels at Due West and Groesbeck.

From Table 2, it will be noted that free-air temperatures at the naval air station, Pensacola, were in close agreement with those at Groesbeck, being slightly higher at the former station. Those at San Diego were highest of all stations.

At 1,000 meters above sea level the free-air resultant winds indicated a southwesternly component over the middle Mississippi Valley and lower Lake region and northwesternly and westernly over the remainder of the country. At 3,000 meters none of the resultant directions contained an appreciable southernly component, except in the extreme Northwest. The easterly component found at 1,000 meters over Brownsville and Key West changed to westerly at 2,000 meters over Brownsville and to north-northwesterly at 3,000 meters over Key West. The monthly resultants for a representative group of stations are shown in Table 3.

A very severe sleet storm occurred at Ellendale on the 18th, 19th, and 20th. The kite record of the 18th was of unusual interest in that it showed a marked rise in temperature from the 17th to 18th between 3,000 and 3,500 meters. The increase amounted to 7° C. at the higher level and was unquestionably greater at still higher elevations beyond the limit of the flight. A significant feature of this high inversion was the fact that the air within it was saturated and 10-tenths alto-stratus clouds from the south-southeast prevailed. On the morning of the 18th a deep Low (29.3 in.) was central over Colorado.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during November, 1930

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De-parture from normal	Mean	De-parture from normal	Mean	De-parture from normal	Mean	De-parture from normal	Mean	De-parture from normal
	TEMPERATURE (° C.)		TEMPERATURE (° C.)		TEMPERATURE (° C.)		TEMPERATURE (° C.)		TEMPERATURE (° C.)	
Surface-----	8.2	-1.5	7.7	-2.9	0.6	+2.9	10.0	-3.2	5.4	+0.7
500-----	8.3	-0.3	7.2	-2.4	0.7	+3.0	10.9	-1.5	4.3	+1.2
1,000-----	7.7	+0.3	6.0	-1.9	2.7	+4.6	9.5	-1.7	2.8	+1.2
1,500-----	5.7	-0.7	4.9	-1.5	2.5	+4.7	7.8	-1.8	1.5	+1.2
2,000-----	3.8	-0.9	3.1	-1.6	0.7	+4.5	5.9	-1.8	0.4	+1.9
2,500-----	1.4	-1.1	0.8	-2.1	-1.6	+4.4	2.9	-2.7	-1.9	+1.5
3,000-----	-0.7	-0.8	-2.0	-2.7	-4.3	+4.3	0.3	-2.9	-4.4	+1.3
4,000-----	-8.8	-4.0	-8.0	-3.2	-9.6	+4.7	-6.1	-3.9	-10.2	+0.3
5,000-----					-15.4	+4.2				

## RELATIVE HUMIDITY (%)

Surface-----	68	+1	74	+3	70	-8	75	+1	73	0
500-----	64	0	68	+2	69	-7	59	-8	70	-2
1,000-----	58	-1	63	+1	57	-8	51	-8	65	-2
1,500-----	55	+3	57	0	51	-7	43	-9	52	-7
2,000-----	53	+6	54	+2	50	-5	45	-1	44	-10
2,500-----	48	+5	48	+4	53	-1	46	+6	40	-10
3,000-----	45	+3	59	+18	56	+2	43	+7	40	-9
4,000-----	45	+10	65	+30	54	-2			36	-9
5,000-----					54	+4				

## VAPOR PRESSURE (mb.)

Surface	7.80	-0.42	8.79	-0.85	4.37	+0.13	10.34	-1.69	7.73	+1.13
500	7.47	+0.07	7.97	-0.53	4.32	+0.16	8.74	-1.79	6.89	+1.05
1,000	6.39	+0.16	6.85	-0.34	4.09	+0.53	6.81	-1.70	5.79	+0.97
1,500	5.25	+0.20	5.69	-0.06	3.60	+0.52	4.88	-1.69	4.18	+0.37
2,000	4.48	+0.56	4.77	+0.28	3.04	+0.43	4.38	-0.51	3.21	+0.17
2,500	3.47	+0.42	4.04	+0.84	2.66	+0.45	3.69	-0.11	2.49	+0.02
3,000	2.75	+0.29	4.31	+1.87	2.25	+0.44	3.09	+0.33	2.25	+0.09
4,000	1.61	-0.27	3.63	+2.51	1.47	+0.28			1.89	+0.63
5,000					0.91	+0.20				

TABLE 2.—Free-air data obtained at naval air stations during November, 1930

Altitude (meters) m. s. l.	TEMPERATURE (° C.)		RELATIVE HUMIDITY (%)	
	Pensacola, Fla.	San Diego, Calif.	Pensacola, Fla.	San Diego, Calif.
Surface-----	11.3	19.1	82	81
500-----	10.4	17.6	76	48
1,000-----	9.0	16.6	72	42
2,000-----	6.2	10.7	61	38
3,000-----	2.6	5.0	46	35